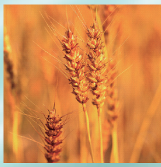
BioResource Now ! Vol.8 No.2



BioResource Now !

Issue Number 8 February 2012

Download the PDF version of this newsletter at
http://www.shigen.nig.ac.jp/shigen/news/

Tracing the origin of genetic resources underlying the basis of modern wheat genetics

Koichiro Tsunewaki
Emeritus Professor,
Kyoto University

Worldwide modern wheat genetics was founded by 2 revolutionary achievements conducted at the School of Agriculture, Hokkaido University, between 1916 and 1924: "Determination of chromosome number and finding of ploidy in the genus *Triticum*" by Dr. Tetsu Sakamura (T. Sakamura, 1918[1]) and "Establishment of genome analysis method based on the elucidation of chrom osomal pairing in interspecies hybrids of the genus *Triticum*" by Dr. Hitoshi Kihara (H. Kihara, 1919[2], 1924[3]). This article describes the historical trail of findings in wheat, which had global impact (Sapporo Agricultural College and College of Agriculture, Tohoku Imperial University are hereafter referred to as School of Agriculture, Hokkaido University).

It is unclear how and why Dr. Sakamura initiated the wheat chromosome research. According to a document titled "The history of Laboratory of Crop Physiology," written by Dr. Yozo Okazawa (professor at the School of Agriculture, Hokkaido University, at that time), "After graduating from the School of Agriculture, Associate Prof. Sakamura researched wheat chromosomes at the Cytology Laboratory in the Tokyo Imperial University under Prof. Kenjiro Fujii as a special stipendiary graduate student." This is a valuable record that narrates Dr. Sakamura s experiences with wheat; however, there is no record regarding his research history neither at the School of Agriculture, Hokkaido University nor at the School of Science, the University of Tokyo. Meanwhile, Dr. Sakamura served as a special stipendiary graduate student for approximately 2 years between December 1916 and August 1918, which overlaps with the season during which Dr. Sakamura determined wheat chromosome number, prepared the paper, and conduct- ed interspecies hybridization between tetraploid and hexaploid wheat species.

Reference
1. Kurze Mitteilung uber die Chromosomenzahlen und die Verwandtschaftsver- haltnis der Triticum- Arten. Bot. Mag. 32 : 150-153, 1918.
2. Uber cytologische Studien bei einigen Getreidearten. Mitteilung I. Spezies-Bastarde des Weizens und Weizenroggen-Bastard. Bot. Mag. 33 : 17-38, 1919.
3. Cytologische und genetische Studien bei wichitigen Getreidearten mit besonderer Rucksicht auf das Verhalten der Chromosomen und die Sterilitat in den Bastarden. Mem. Coll. Sci. Kyoto Imp. Univ., 1924.

Therefore, it could not have been possible for him to have engaged in research under Prof. Fujii at the University of Tokyo for an extended period.

In this manner, the historical trail of Dr. Sakamura' s work with wheat is uncertain; nevertheless, he used a wheat strain that was collected by Dr. Takajiro Minami (the first farm foreman and professor of the Laboratory of Agronomy No. 1 of the School of Agriculture, Faculty of Agriculture, Hokkaido University) in his breakthrough research, which was obvious from the note—"All the materials were provided by courtesy of Prof. T. Minami and Assistant Prof. M. Ito at the Crop Science Laboratory, Hokkaido University"— in his paper, "Short communication on the chromosome number and the strain relationship in the species belonging to the genus *Triticum*." [1]

In the summer of 1917, Dr. Sakamura conducted further interspecies hybridization between a female tetraploid wheat strain and a hexaploid wheat strain as the pollen parent and obtained seeds of 3 pentaploid hybrid combinations. Although he planted the seeds in the spring of 1918, he was appointed to engage in overseas research as a candidate professor in the Laboratory of Plant Physiology by the Ministry of Education and was scheduled to leave the country to travel to Europe and the United States in the fall. Thus, he offered the research in these pentaploid hybrids to Dr. Hitoshi Kihara, who had been accepted to the graduate school in August of that year (according to "Wheat" written by Dr. Hitoshi Kihara).

In the summer of that year, Dr. Kihara prepared slides showing meiosis of the pentaploid wheat hybrids developed by Dr. Sakamura and received his guidance for further research. Dr. Kihara described in his book, *Ichiryusha shujin shashinfu*, that "a few minutes of advice from Dr. Sakamura regarding the prepared slides before he left the country were the beginning of my involvement in the subsequent wheat research."

From these facts, it is certain that the research materials used by both Dr. Sakamura and Dr. Kihara to establish modern wheat genetics were derived from the collection of Dr. Takajiro Minami. Dr. Minami served as the farm foreman and the dean of the School of Agriculture, Hokkaido University, between 1900 and 1927 and then became the 2nd president of the Hokkaido University. During his service at the School of Agriculture, Dr. Minami introduced gramineous crops such as wheat and barley from abroad. Among the crops introduced, the wheat strains that were obtained from Dr. C. Flaksberger at the Bureau of Applied Botany, the Russian Ministry of Agriculture were the only samples probably used by both Dr. Sakamura and Dr. Kihara as research materials.

One of the documents preserved at the Division of Bioresources and Product Science, Research Faculty of Agriculture, Hokkaido University is titled, "Ancient Documents of the Laboratory of Agronomy No. 1 of the School of Agriculture, Faculty of Agriculture." The document includes a letter by Dr. Minami dated October 7, 1915, in which was written a request to Dr. Flaksberger for distributing the seeds of 4 crops, including Russian wheat varieties. In response to this request, Dr. Flaksberger sent the seeds of 4 crops, including 18 wheat strains to Dr. Minami, which was clear in a letter of appreciation that was sent from Dr. Minami to Dr. Flaksberger dated May 19, 1916. Therefore, the seeds were thought to have arrived at the Hokkaido University between November 1915 and May 1916. Since Dr. Flaksberger is a wheat taxonomist, the wheat strains delivered to Dr. Minami were likely to have been described using their scientific names. Unfortunately, there is no record on the strains that Dr. Minami received; thus, it cannot be confirmed whether the resources used by Dr. Sakamura and Dr. Kihara were both obtained from Dr. Flaksberger.

To the next page

Hence, I investigated the consistency between the arrival date of the wheat strains and the season when Dr. Sakamura and Dr. Kihara published their research achievements. The wheat strains used by the doctors were spring varieties. According to the remaining documents of Dr. Minami at the Hokkaido University, spring wheat varieties were cultivated by sowing seeds in the beginning of May, observing head sprouts in the beginning to middle of July, and harvesting the crop in the end of August. If the wheat strains of Dr. Flaksberger had arrived by April 1916, the seeds could have been planted in May and harvested in August of that year. Accordingly, after Dr. Sakamura received the seeds from Dr. Minami that had been once proliferated at the Hokkaido University, he determined the chromosome number by observing somatic cell divisions and submitted an article on the basis of the results, probably between the winter of that year and early spring of 1917. Dr. Sakamura then planted the remaining seeds, possibly in April 1917, crossbred strains with different chromosome numbers in the summer, planted the seeds of the hybrids perhaps in the spring of 1918, and inspected the pollen mother cells in the summer along with the assistance of Dr. Kihara. The proposed time course of these events is consistent with the time of the aforementioned research and the achievements published by Dr. Sakamura and Dr. Kihara. From the above circumstantial evidences, it is highly probable that the wheat strains that Dr. Minami received from Dr. Flaksberger were the resources that were used by Dr. Sakamura and Dr. Kihara in their research that achieved global impact.
(This article is based on my article in "Annual Report of Hokkaido University Archives, 6: 1-14, Hokkaido University.")

In-depth use of Windows 7 !

Ongoing Column [No. 66] 10min

"BitLocker To Go," an encryption measure for USB memory

A top-ranked cause of accidental information leak via USB memory

The number of people whose individual information has been leaked via portable record media such as USB memory is over 1 million, which is second to leaks via the Internet (Fig. 1) according to "Survey Report of Information Security Incident 2010 (only Japanese) " released by the Japan Network Security Association last summer. The reason is insufficient security awareness and management systems when using the media, even though both users and information volume brought out of offices have increased because of price reductions and hard-disk capacity increases.

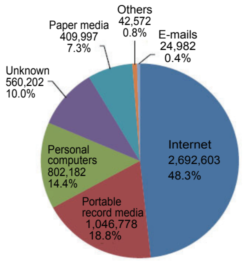


Fig. 1: Media and paths (number of people) of information leakage [Ref. : "Survey Report of Information Security Incident 2010"]

Although a 16- or 32-GB high-capacity USB memory can be easily purchased for several thousand yen at an electronics mass retailer, the damage caused when losing the memory device is immeasurable because of its large storage capacity. Therefore, BitLocker To Go, which is an encryption function, was introduced in this issue.

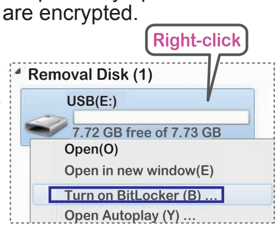
"BitLocker To Go," is a function for encrypting the entire contents of USB memory or an external hard-disk drive (HDD)

The "BitLocker To Go" function protects all information on a disk, including documents and passwords by encrypting the entire data stored in a USB memory or an external HDD. As long as this function is activated, all files saved to the hard disk are automatically encrypted. Even in the unlikely event of losing the USB memory device, none of the internal data can be surreptitiously opened unless the password is entered because the data are encrypted.

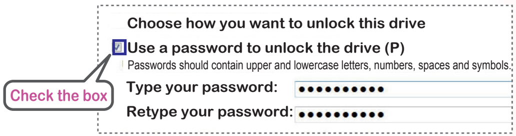
Configuration of "BitLocker To Go"

Configuring "BitLocker To Go" is a very simple process.

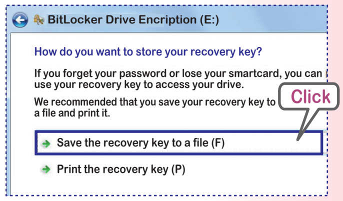
① Right-click the USB memory icon to be encrypted and select "Turn on BitLocker..." from the pop-up menu.



② Check "Use a password to unlock the drive," input the password, and click "Next."



③ The system will prompt you to insert a recovery keyword in case the password is forgotten.

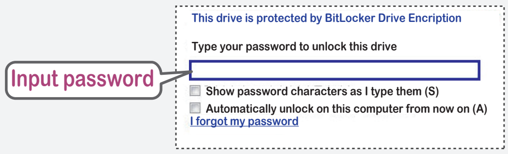


Click "Save the recovery key to a file." The system will prompt you to specify where the destination to save the file. Specify the desired destination and save the recovery key file.

④ When the final confirmation window is displayed, click the "Start Encrypting" button to initiate the encryption process; once the process is complete, the device will have been encrypted.

How to use an encrypted USB memory device

To use an encrypted USB memory device, it is necessary to input the configured password.



The most important security measure while using a USB memory device is to avoid losing the device. Nevertheless, as a security measure in case of loss of the device, it is recommended to encrypt USB memory devices using "BitLocker To Go". (Takehiro Yamakawa)

Recommended Book ! 〈NO.2〉

"Why are our thumbs so thick? (親指はなぜ太いのか)"

by Taizo Shima (Chukoshinsho, 2003) only Japanese

The title of the book, although misleading, may provide a casual impression of its content, which is important as well as scholarly and also conveyed by the subtitle, "Tracing the roots of the erect bipedalism (直立二足歩行の起原に迫る) ." The author is a leading scientist in aye-aye (a prosimian) research who performed continuous field observations in the island of Madagascar. Therefore, the book starts with a story on the strange hands of aye-ayes and explains that the bizarrely long and thin middle fingers of the aye-ayes are, in fact, the result of adaptation so that they can claw through ramy nuts and eat the fleshy inside of the nut.

The author then proposes " The hand-in-mouth hypothesis (口と手連合仮説)" since the hands and mouth (especially teeth) of primates are adapted to eating their respective staple foods. The author then verifies his hypothesis by applying it to each species including loris, lemur, indri, tarsier, coaita, Japanese monkey, chimpanzee, and gorilla. Finally, the author discusses on humans, and the story becomes even more intriguing, like a mystery novel.

Thus far, many theories have been mentioned in terms of the staple food of early man, but none seemed to have sufficient evidence to win the argument. In his book, the author applied his hypothesis and predicted an inconceivably unexpected food as the staple diet of early man, which was derived from the characteristics of human hands and teeth (read the book and find out what it is!). The author claims that if the hypothesized staple food is taken into consideration, then erect bipedal-ism, which is considered the first critical mystery in human evolution, can be reasonably explained (K.N.).

Contact Address
Center for Genetic Resource Information,
National Institute of Genetics
1111 Yata, Mishima-shi, Shizuoka 411-8540, Japan
Tel.: 055-981-6885 (Yamazaki)
E-mail brnews@chanko.lab.nig.ac.jp

Editor's Note

Dr. Tsunewaki, a leading geneticist of plant organelles, elucidated the origin and strain relationship of wheat by initially analyzing the nucleus and cytosol of hybrid strains and then the organelle genomes. When I joined working with him during analysis of mitochondrial genome of wheat in 2005 and faced obstacles in assembling the sequences in a computer because of the presence of numerous recombination sites, Dr. Tsunewaki could easily solve the problem by simply using a piece of paper and paste, which was an unforgettable experience. In this issue of the newsletter, Dr. Tsunewaki has contributed a chapter based on the article he authored in the 6th Annual Report of Hokkaido University Archives, Hokkaido University (March 2011). I am curious about the readers' impressions on the mystery of the resources used in the historical wheat research. I am eager to obtain the list of seeds that was sent by Dr. Flaksberger (Y.Y.).

BioResource Information

(NBRP) www.nbrp.jp/
(SHIGEN) www.shigen.nig.ac.jp/
(WGR) www.shigen.nig.ac.jp/wgr/
(JGR) www.shigen.nig.ac.jp/wgr/jgr/jgrUrlList.jsp

BioResource Now !
Issue Number 8 February 2012
"translated by ASL translation service"